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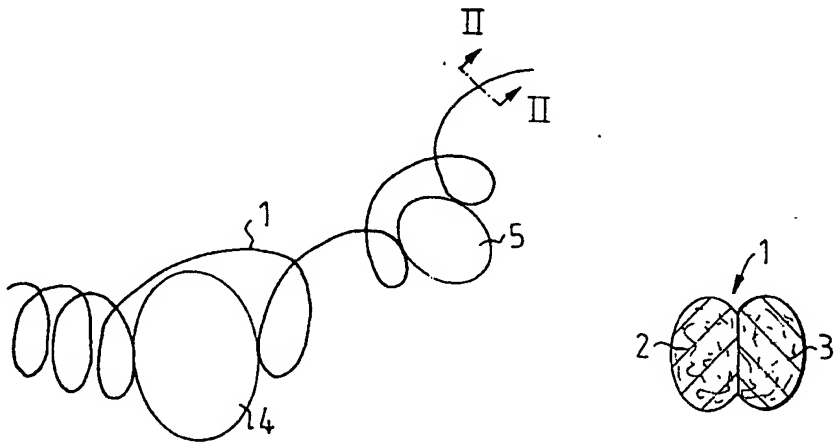

(57) Abstract

The present invention relates to an absorbent fibre structure and also to an article which includes one such fibre structure. The structure comprises a mixture of heat-shrunk, spiralized, elastic thermoplastic bicomponent fibres (1), wherein the fibre components (2, 3) have mutually different shrinkage properties and are present in side-by-side relationship, and further comprises at least one type of particulate, superabsorbent material (4, 5), wherein the superabsorbent material (4, 5) is retained in the fibre structure mainly by being locked mechanically in the turns and windings of the spiralized bicomponent fibres (1).

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Absorbent Fibre Structure

The present invention relates to an absorbent fibre structure and also to an article which includes one such fibre structure.

It is earlier known to mix highly absorbent hydrocolloidal particles, so-called superabsorbents, in fibre structures for absorption purposes. Such fibre structures are described, for instance, in U.S. 4,340,556, EP 137,644 and EP 172,035. One difficulty in this respect, however, is that of securing the superabsorbent particles in the fibre structure, so that the fibre structure can be handled during manufacture and transportation without the superabsorbents being redistributed in the structure or shaken therefrom.

EP 210,968 describes an absorbent fibre structure which is comprised of a mixture of absorbent fibres, heat-actuable binder and superabsorbent material. The heat-actuable binder functions to hold the fibre structure together, by binding the individual fibres together, and also to secure the superabsorbent material in the fibre structure. Although such a fibre structure has good handling properties, the heat-actuable binder, however, settles on the surface of the superabsorbent material and therewith reduces the available absorption area of said material. Furthermore, the absorbency of the superabsorbents is influenced negatively when the fibre structure is so strongly bonded as to limit the extent to which the superabsorbents can swell when absorbing fluid.

The present invention, however, provides a fibre structure of the kind defined in the introduction with which a large amount of superabsorbent material can be

retained effectively in a fibre structure which has a relatively low degree of binding. An inventive fibre structure is mainly characterized in that the structure includes a mixture of heat-shrunk, spiralized thermoplastic bicomponent fibres, said structure com-ponents having mutually different shrink properties and lying in side-by-side relationship, and at least one type of particulate superabsorbent material, wherein the superabsorbent material is retained in the fibre structure mainly as a result of being locked mechanically in the windings or turns of the spiralized bicomponent fibres.

In one preferred embodiment, the main components of the bicomponent fibres have the form of two types of polypropylene which have mutually different melting points and mutually different shrink properties.

In other embodiments, the main components of the bicomponent fibres are polypropylene and polyester.

In another embodiment, the fibre structure includes hydrophilic fibres, such as viscose fibres, polyester fibres or cellulose fluff, for instance.

In yet another embodiment, the fibre structure includes thermoplastic bonding fibres, such as polypropylene or polyethylene fibres, for instance.

In still another embodiment, the fibre structure has the form of a fibre mat rolled-up to form a strand.

The present invention also relates to an article, such as a diaper, a sanitary napkin or an incontinence guard. The inventive article is mainly characterized in that it includes an absorbent layer which comprises a mixture of

heat-shrunk, spiralized thermoplastic bicomponent fibres.

In one embodiment, the absorbent pad or body includes an insulating layer which is placed on that side of the absorbent layer which is intended to lie proximal to the wearer in use and which is comprised of a porous, essentially non-absorbent, hydrophilic non-woven fabric.

In another embodiment, the article is a diaper which includes a rear part which, when the article is in use, is intended to lie distal from the wearer, a front part which is intended to lie proximal to the wearer in use, and a narrower crotch part which is located between the rear diaper part and the front diaper part and which, in use, is intended to lie in the crotch region between the wearer's thighs, and which further includes elastic devices which extend in the longitudinal direction of the diaper to form leg elastication, said elastic devices being comprised of a fibre mat rolled together to form a strand and including shrunk, spiralized bicomponent fibres of the side-by-side type, and superabsorbent particles.

By mixing shrinkable bicomponent fibres of the side-by-side type in a fibre structure in accordance with the present invention, it is possible to mechanically retain particulate material in the fibre structure to a high degree. It is essential in this regard that the two components in the shrink fibres will shrink or contract to different extents when subjected to heat. In this way, the shrunken fibres will form spirals in whose windings or turns the superabsorbent particles and other constituents of the fibre structure can be held firmly. The shrunk bicomponent fibres have a high degree of elasticity, thereby providing the particles retained in

the spirals a certain degree of freedom of movement in the fibre structure. This is particularly advantageous, since the risk of the particles loosening and falling from the fibre structure when the structure is handled is lower than in the case of fibre structures in which the particles, for instance, have been firmly bonded with the aid of a meltable adhesive. Such bonds are easily broken when the fibre structure is subjected to mechanical forces and therewith lose their effect. Furthermore, an inventive fibre structure permits practically unobstructed swelling of the superabsorbent particles as the particles absorb liquid, since the fibre spirals stretch in keeping with the swelling of the superabsorbents.

The invention will now be described in more detail with reference to exemplifying embodiments thereof illustrated in the accompanying drawings.

Figure 1 illustrates a superabsorbent particle held by a spiralized bicomponent fibre.

Figure 2 is a sectional view of the bicomponent fibre shown in Figure 1, taken on the line II-II.

Figure 3 illustrates a diaper which includes an inventive, absorbent fibre structure; and Figure 4 is a sectional view of the diaper in Figure 3, taken on the line IV-IV.

The bicomponent fibre 1 illustrated in Figures 1 and 2 is of the so-called side-by-side type which, as the name implies, means that its two components 2, 3 lie by the side of one another in the longitudinal direction of the fibres. It is essential to the invention that the fibre components chosen will shrink or contract to mutually

different extents. When a bicomponent fibre of this nature is heated, the two components will shrink to different extents, so that one side of the fibre will be shorter than the other and the fibre will twist and contract to form a spiral. A bicomponent fibre suitable for this purpose is sold by Chisso Corporation, Osaka, Japan, under the designation EP-HS 2 and is a 2-denier thick shrink and melt fibre consisting of two different polypropylenes, one having a high melting point and the other a low melting point.

As shown in Figure 1, the spiralized fibre 1 is able to retain particles 4, 5, for instance grains of superabsorbent material, in its turns or windings purely mechanically. As previously mentioned, the particles are held elastically so as to allow the held particles to move to a certain extent and also to allow the particles to swell as they absorb fluid.

The term particle as used here shall be given a relatively wide interpretation and shall be considered to include both superabsorbent grains and also superabsorbents in granular, flake and short-fibre form. By superabsorbent material is normally meant a material which is able to absorb liquid in quantities corresponding to many times its own weight and therewith swell and form a water-immiscible gel without losing its original particle form. Many variations of superabsorbents having different chemical compositions are commercially available. The chemical composition of the superabsorbent used is not significant to the invention, however, and any particulate superabsorbent whose absorption properties have been found suitable for the purpose intended can be used. Naturally, mixtures of different superabsorbents can also be used.

The diaper illustrated in Figure 3 includes a liquid-permeable casing layer 6, made for instance of non-woven fabric or perforated plastic film, a liquid-impermeable casing layer 7, made for instance from plastic film or from hydrophobic non-woven fabric, and an absorbent pad 8 enclosed between the two layers 6, 7. The diaper is intended to be worn as a pair of absorbent pants and, to this end, is provided with a rear part 9 which is intended to lie distal from the wearer in use, a front part 10 which is intended to be proximal to the wearer in use, and a narrower crotch part 11 which is located between the rear part and the front part and, in use, is intended to lie in the crotch region of the wearer, between the wearer's thighs. In order to enable the diaper to be secured in use in a pants-like configuration, fastener tabs 12, 13 are mounted on both side edges 14, 15 of the diaper, close to the rear waist edge 16 thereof. In use, the fastener tabs 12, 13 are fastened to the outer surface of the front part of the diaper, close to the front waist edge, thereby holding the diaper securely around the wearer's waist. The diaper also includes elastic devices 18, 19 which extend over the diaper in a V-shaped pattern, with the apex of the V located at the front waist edge 17 of the diaper and with the legs of the V extending towards the rear waist edge 16 of the diaper and terminating adjacent the two fastener tabs 12, 13. The elastic devices consist of a fibre mat of bicomponent fibres which have been covered with superabsorbent particles and rolled-up to form a strand 20, which is shown in section in Figure 4. This rolled fibre strand 20 was then heat-treated so as to spiralize the bicomponent fibres and to melt the fibres to some extent. The superabsorbents are, in this way, held firmly in the fibre structure while the afore-indicated partial melting of the bicomponent fibres results in binding the fibre mat and therewith retaining

the mat in its rolled-up state. Shrinking of the fibres imparts a given elasticity to the fibre strand 20 and fibre strands can therefore be used as elastic devices 18, 19 for sealing and tensioning the leg edges of a diaper around the legs of the wearer.

Figure 3 illustrates the elastic devices 18, 19 of the diaper in a stretched or extended state. However, when the diaper is worn, the elastic devices 18, 19 will contract and form elastic, raised leg openings around the wearer's legs. As distinct from conventional elastic devices, which normally consist of elastic bands, or covered elastic threads, the elastic devices constructed in accordance with the invention are extremely soft and comfortable and will not chafe or irritate the wearer's skin. Furthermore, the elastic devices 18, 19 used with the diaper illustrated in Figures 3-5 allow air and water vapour to pass through while preventing liquid from flowing from the diaper, because the superabsorbents absorb and chemically bind any liquid that reaches the elastic devices. Naturally, this will contribute to the feeling of dryness of the diaper and enhance its comfort in use.

The absorbent pad 8 of the diaper comprises an insulating layer 21 which is placed on that side of the pad 8 which faces the liquid-permeable casing layer 6, and an absorbent layer 22 which is placed on that side of the pad 8 which faces the liquid-impermeable casing layer 7. The insulating layer 21 is suitably a porous, non-absorbent but hydrophilic non-woven fabric which will allow body fluid to pass through quickly to the underlying absorbent layer 22. The insulating layer 21 also functions to prevent the transportation of liquid back from the absorbent layer 22 to the liquid-permeable casing layer 6. According to the invention, the

absorbent layer 22 is comprised of a structure which contains firmly held superabsorbent particles. A fibre structure found to have suitable properties in the present context includes 40 percent by weight polypropylene/polyethylene bicomponent fibres having a thickness of 2 denier, 40 percent by weight polyester fibres having a thickness of 17 dtex, 20 percent by weight of viscose fibres having a thickness of 1.7 dtex, and superabsorbent particles. As previously mentioned, the superabsorbent particles are retained in the fibre structure by heat-treating the structure so as to spiralize the bicomponent fibres. Because the bicomponent fibres are melted partially in the heat-treatment process, they will also function as a binder for the fibre structure itself. As will be understood, the absorbent layer may conceivably comprise a number of alternative fibre mixtures. For instance, the proportions in which the various fibres are present may be changed, as can also the thickness of the fibres. Furthermore, other types of absorbent or non-absorbent fibres can be used, for instance cellulose fluff, cotton, viscose, polyethylene fibres, polyester fibres, polypropylene fibres or polyamide fibres. However, the fibre structure will suitably include at least 10% bicomponent fibres of the side-by-side type, since the binding effect achieved with lower mixture proportions is practically negligible. The absorbent layer itself may also comprise different layers of mutually different fibre mixtures or with varying quantities of superabsorbents. For instance, it may be advantageous to arrange a first layer of relatively low absorbency and relatively high through-transportation ability and high elasticity on that side of the absorbent layer which is intended to face the wearer in use. Such a layer will be soft to the wearer's skin and will also contribute to the feeling of dryness of that surface which lies against the wearer's

skin in use. This is achieved because the layer includes a relatively large proportion of non-absorbent fibres, for instance polypropylene, polyethylene, polyester or polyamide, and only a small amount of superabsorbent.

Outwardly of the first layer, there is placed a highly absorbent second layer of high liquid-dispersion ability. These properties are obtained when the layer contains a high proportion of hydrophilic, liquid-transporting fibres, for instance cellulose fibres, and has a relatively high superabsorbent content, suitably a content corresponding to about 1 g superabsorbent/5 g fibres.

As will be understood, the absorbent pad of the diaper illustrated in Figures 3-5 may also include other components, such as separate dispersion layers or reinforcing layers and further absorbent layers comprised, for instance, of cellulose fluff.

It will also be understood that the described absorbent fibre structure may be used in absorbent articles other than diapers. For instance, the fibre structure is particularly suited for use in sanitary napkins, which as a result of the invention can be given a thinness which renders the napkin discrete and comfortable to wear despite its high absorbency. The possibility of obtaining a highly absorbent, small and discrete article is also greatly appreciated by adults who find it necessary to wear an absorbent incontinence guard. The absorbent fibre structure can also be used effectively in tampons, surgical dressings and bandages and in different types of drying cloths and guards, such as bed protectors or toilet seat coverings.

A soft, flexible and resilient or elastic fibre structure particularly suitable for surgical dressings is obtained with a mixture of about 70 percent by weight EP-HS 2-fibre and about 30 percent by weight viscose fibres.

The fibre structure may, of course, include other components, such as odour-inhibiting agents or healing-promoting agents.

It will be understood that the invention is not restricted to the aforedescribed embodiments and that a number of further modifications are conceivable within the scope of the following Claims.

Claims

1. An absorbent fibre structure, c h a r a c t e r i z e d in that the structure comprises a mixture of heat-shrunk, spiralized elastic thermoplastic bicomponent fibres (1), wherein the fibre components (2, 3) have mutually different shrinkage properties and are present in side-by-side relationship, and at least one type of particulate superabsorbent material (4, 5), wherein the superabsorbent material (4, 5) is retained in the fibre structure mainly by being locked mechanically in the windings or turns of the spiralized bicomponent fibres (1).

2. An absorbent fibre structure according to Claim 1, c h a r a c t e r i z e d in that the main components (2, 3) of the bicomponent fibres (1) are two different types of polypropylene.

3. An absorbent elastic fibre structure according to Claim 1, c h a r a c t e r i z e d in that the main components (2, 3) of the bicomponent fibres (1) are polypropylene and polyester.

4. An absorbent fibre structure according to any one of Claims 1-3, c h a r a c t e r i z e d in that the structure includes hydrophilic fibres, such as viscose fibres, polyester fibres or cellulose fluff, for instance.

5. An absorbent fibre structure according to any one of the preceding Claims, c h a r a c t e r i z e d in that the structure includes thermoplastic binding fibres consisting, for instance, of polypropylene, polyethylene or thermoplastic bicomponent fibres.

6. An absorbent fibre structure according to any one of the preceding Claims, c h a r a c t e r i z e d in that the structure has the form of a fibre mat rolled-up to a strand form (20).

7. An absorbent article, such as a sanitary napkin, a diaper, a wound dressing or an incontinence guard which comprises an absorbent pad (8) enclosed in a casing (6, 7) having a liquid-permeable region (6) on that side of the article which faces the wearer in use, and a liquid-impermeable region (7) on that side of the article which is distal from the wearer in use, c h a r a c t e r i z e d in that the absorbent pad (8) has an absorbent layer (22) which includes a mixture of heat-shrunk, spiralized, elastic thermoplastic bicomponent fibres (1).

8. An absorbent article according to Claim 7, c h a r a c t e r i z e d in that the absorbent pad (8) has an insulating layer (21) which is placed on that side of the absorbent layer (22) which faces the liquid-permeable region (6) of the casing (6, 7); and in that the insulating layer (21) is comprised of a porous, essentially non-absorbent, hydrophilic non-woven fabric.

9. A diaper according to Claim 7 or 8, c h a r a c t e r i z e d in that the diaper includes a back part (9) which is intended to face rearwardly of the wearer in use, a front part (10) which is intended to face forwardly of the wearer in use, and a narrower crotch part (11) which is located between said back part (9) and said front part (10) and which is intended to be located in the crotch region of the wearer in use, between the wearer's thighs, and further includes elastic devices (18, 19) which extend in the longitudinal direction (15) of the diaper to form leg elastication, wherein the

elastic devices (18, 19) are comprised of a fibre mat which is rolled-up to form a strand (20) and which includes shrunken, spiralized bicomponent fibres (1) of the side-by-side type, and superabsorbent particles (4, 5).

AMENDED CLAIMS
[received by the International Bureau on 2 July 1993 (02.07.93);
original claims 1,3,7 and 9 amended;
other claims unchanged (3 pages)]

1. An absorbent fibre structure, c h a r a c - t e r i z e d in that the structure comprises a mixture of heat-shrunk, spiralized elastic thermoplastic bicomponent fibres (1), wherein the fibre components (2, 3) have mutually different shrinkage properties and are present in side-by-side relationship, and at least one type of particulate superabsorbent material (4, 5), wherein the superabsorbent material (4, 5) is retained in the fibre structure mainly by being locked mechanically in the windings or turns of the spiralized bicomponent fibres (1).

2. An absorbent fibre structure according to Claim 1, c h a r a c t e r i z e d in that the main components (2, 3) of the bicomponent fibres (1) are two different types of polypropylene.

3. An absorbent fibre structure according to Claim 1, c h a r a c t e r i z e d in that the main components (2, 3) of the bicomponent fibres (1) are polypropylene and polyester.

4. An absorbent fibre structure according to any one of Claims 1-3, c h a r a c t e r i z e d in that the structure includes hydrophilic fibres, such as viscose fibres, polyester fibres or cellulose fluff, for instance.

5. An absorbent fibre structure according to any one of the preceding Claims, c h a r a c t e r i z e d in that the structure includes thermoplastic binding fibres consisting, for instance, of polypropylene, polyethylene or thermoplastic bicomponent fibres.

6. An absorbent fibre structure according to any one of the preceding Claims, c h a r a c t e r i z e d in that the structure has the form of a fibre mat rolled-up to a strand form (20).

7. An absorbent article, such as a sanitary napkin, a diaper, a wound dressing or an incontinence guard which comprises an absorbent pad (8) enclosed in a casing (6, 7) having a liquid-permeable region (6) on that side of the article which faces the wearer in use, and a liquid-impermeable region (7) on that side of the article which is distal from the wearer in use, c h a r a c t e r i z e d in that the absorbent pad (8) has an absorbent layer (22) with a fibre structure which includes a mixture of heat-shrunk, spiralized, elastic thermoplastic bicomponent fibres (1), wherein the fibre components (2, 3) have mutually different shrinkage properties and are present in side-by-side relationship, and at least one type of particulate superabsorbent material (4, 5), wherein the super-absorbent material (4, 5) is retained in the fibre structure mainly by being locked mechanically in the windings or turns of the spiralized bicomponent fibres (1).

8. An absorbent article according to Claim 7, c h a r a c t e r i z e d in that the absorbent pad (8) has an insulating layer (21) which is placed on that side of the absorbent layer (22) which faces the liquid-permeable region (6) of the casing (6, 7); and in that the insulating layer (21) is comprised of a porous, essentially non-absorbent, hydrophilic non-woven fabric.

9. An absorbent article according to Claim 7 or 8 in the form of a diaper, c h a r a c t e r i z e d in

that the diaper includes a back part (9) which is intended to face rearwardly of the wearer in use, a front part (10) which is intended to face forwardly of the wearer in use, and a narrower crotch part (11) which is located between said back part (9) and said front part (10) and which is intended to be located in the crotch region of the wearer in use, between the wearer's thighs, and further includes elastic devices (18, 19) which extend in the longitudinal direction (15) of the diaper to form leg elastication, wherein the elastic devices (18, 19) are comprised of a fibre mat which is rolled-up to form a strand (20) and which includes shrunken, spiralized bicomponent fibres (1) of the side-by-side type, and superabsorbent particles (4, 5).

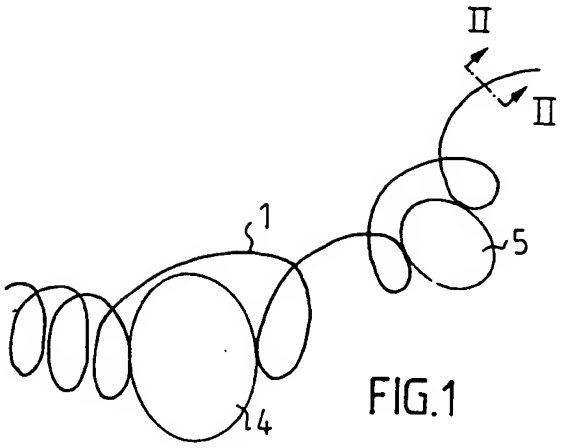

FIG.1

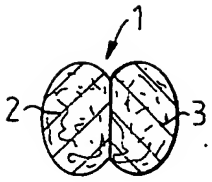

FIG.2

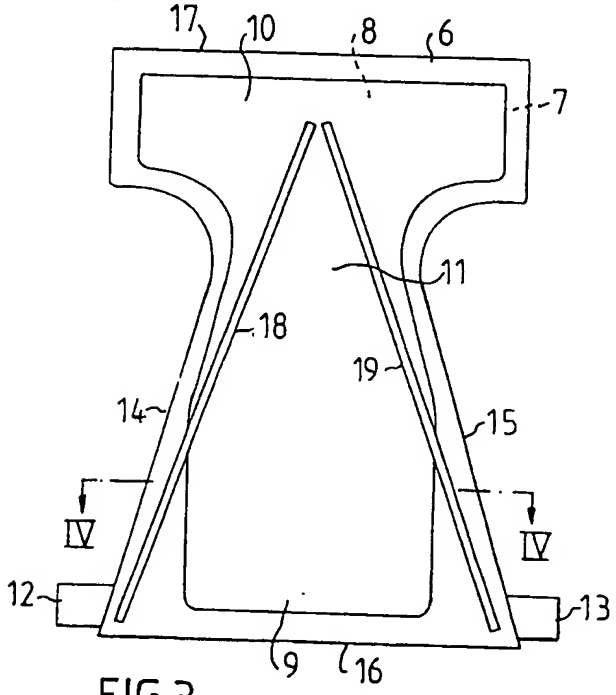

FIG.3

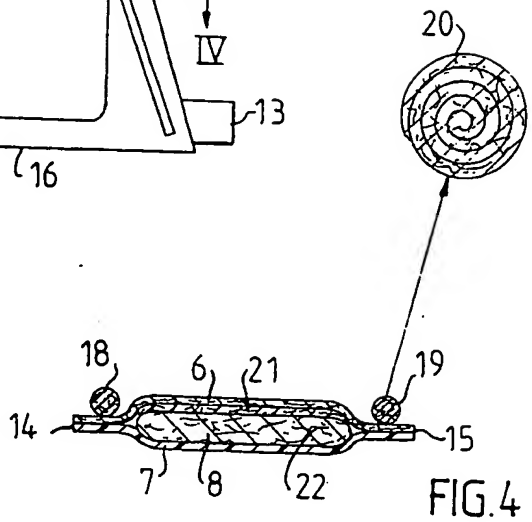

FIG.4

INTERNATIONAL SEARCH REPORT

International application No.
PCT/SE 93/00087

A. CLASSIFICATION OF SUBJECT MATTER

IPC5: D04H 1/50, A61F 13/18, B32B 5/08
According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC5: D04H, A61F, B32B

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

SE,DK,FI,NO classes as above

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	EP, A3, 0137644 (PERSONAL PRODUCTS COMPANY), 17 April 1985 (17.04.85), page 12, line 11 - line 23, claims 14-16 --	7,8
A	US, A, 5043209 (BOISSE ET AL), 27 August 1991 (27.08.91), claim 1 --	1-9
A	US, A, 4883707 (NEWKIRK), 28 November 1989 (28.11.89), claim 1 -- --------	1-9

☐ Further documents are listed in the continuation of Box C. ☒ See patent family annex.

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Date of the actual completion of the international search	Date of mailing of the international search report
5 May 1993	07 -05- 1993
Name and mailing address of the ISA/ Swedish Patent Office Box 5055, S-102 42 STOCKHOLM Facsimile No. +46 8 666 02 86	Authorized officer Nils Ekström Telephone No. +46 8 782 25 00

INTERNATIONAL SEARCH REPORT

Information on patent family members

31/03/93

International application No.
PCT/SE 93/00087

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
EP-A3- 0137644	17/04/85	SE-T3- 0137644	
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		JP-A- 60052603	25/03/85
		US-A- 4578070	25/03/86
		CA-A- 1253320	02/05/89
		CA-A- 1253319	02/05/89
US-A- 5043209	27/08/91	NONE	
US-A- 4883707	28/11/89	NONE	